Worksheet: Electron Arrangement

Long Method Energy Level Energy Level Electron Configuration Orbital Notation Electron Dot

Notation Diagram

(Shell Notation) (Shell Diagram)

1. Boron

2. Gallium

3. 12 e’s

4. 9 e’s

Short Method

Noble Gas Core

5. Zirconium X X

6. Gold X X

7. 95 e’s X X

8. 63 e’s X X

Long Method Energy Level Energy Level Electron Configuration Orbital Notation Electron Dot

Notation Diagram

(Shell Notation) (Shell Diagram)

1. Neon

2. Phosphorus

3. 28 e’s

4. 11 e’s

Short Method

Noble Gas Core

5. Astatine X X

6. Tin X X

7. 66 e’s X X

8. 91 e’s X X

Long Method Energy Level Energy Level Electron Configuration Orbital Notation Electron Dot

Notation Diagram

(Shell Notation) (Shell Diagram)

1. Helium

2. Nitrogen

3. 13 e’s

4. 17 e’s

Short Method

Noble Gas Core

5. Titanium X X

6. Silver X X

7. 58 e’s X X

8. 92 e’s X X

Flame Tests Lab

Introduction:

When elements are heated to high temperatures, they may be placed in an excited state. In an excited state, the electrons move to higher energy levels. The changes in energy that occur when the excited atoms return to their ground state cause the substance to be luminous or emit light. The observed colors or spectrum of the substance is caused by the set of visible wavelengths of light emitted. Since each element emits a unique set of wavelengths, emission spectra can be used as a tool to identify the elements.

One method used to demonstrate the emission spectrum of a substance is the flame test. Using this method, a small amount of a substance is heated and the characteristic glow of the substance is observed. In this experiment, you will perform a flame test on several metallic salts. Based on your observations, you will develop a reference table which lists the flame color for each metal ion. You will then perform a flame test on an unknown substance. By comparing your observations to the data in your reference table, you will be able to identify the metal ion in the unknown substance. Finally, you will use cobalt glass as a tool for identifying the components of a metallic salt mixture.

Purpose:

In this experiment, you will

a. observe the spectra emitted from selected ions

b. identify metallic ions by the color emitted during vaporization of the element

c. evaluate the usefulness of this method of metal identification.

Materials:

Platinum(nichrome) wire, laboratory burner, watch glass, Barnes dropping bottle, cobalt glass, concentrated HCl, metallic nitrate samples.

Procedure:

We will discuss this in class.

Data Table:

Metal Ion Flame Color

|  |  |
| --- | --- |
| Sodium nitrate |  |
| Barium nitrate |  |
| Calcium nitrate |  |
| Copper(II) nitrate |  |
| Potassium nitrate |  |
| Strontium nitrate |  |
| Lithium nitrate |  |
| Unknown |  |

Metal Ion Flame Color with Cobalt Glass

|  |  |
| --- | --- |
| Sodium nitrate |  |
| Potassium nitrate |  |
| Mixture of sodium nitrate and potassium nitrate |  |

Discussion Questions:

1. What do you predict to be the unknown sample of the metallic ion? Defend your answer

2. Do you think this is a practical method for a MIXTURE of several metallic ions? Why or why not?

3. Why was the potassium ion visible through the cobalt glass?

4. What effect did nitrate have on the color of the metallic ion?

5. State two reasons why the flame test would NOT be a reliable test for identification of the metallic ion.

6. If we looked through a spectroscope, what would we observe? (This is in preparation for our second part of this lab)

To get the A for honors chemistry:

1. What is the difference between emission spectra and absorption spectra

2. Explain the science behind advertising lights (noble gases). Do some research to explain and state your source.

3. Do research to find the color of 5 additional metallic nitrates that we did not investigate. State the metal and its corresponding color. Include your source.

Spectroscope Lab

A spectroscope contains a diffraction grating that separates electromagnetic radiation into its component wavelengths. The spectroscope can be used to measure absorption or emission spectra.

All spectra instruments do basically one thing. They break light (electromagnetic radiation) into is constituent components. In the visible, white light will be dispersed into the colors ROYGBIV (red, orange, yellow, green, blue, indigo, violet). We will be using a spectroscope to observe these spectral lines.

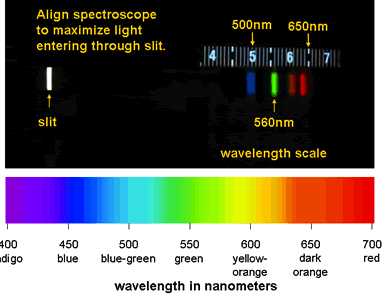
All gases when heated to high temperatures will give off light at particular wavelengths characteristic to the number of electrons in the atomic orbits of the material. Every element has its own “fingerprint”. Therefore when the light from the sun and stars are observed, element in the atmospheres of stars are detectable as characteristic wavelengths.

When light other than a white light is passed through a prism, a series of lines appear other than a continuous spectrum These lines of color are called bright line spectra. These lines can be produced by either flame tests or spectroscope. Different elements give its own unique set of spectral lines. These spectral lines are the fingerprints of elements. If many atoms in a sample of an element are excited by radiation sources, they give off various frequencies of radiation as their electrons drop back to their ground state energy levels. This is often referred to as fluorescence. It is the emission of visible light from a substance under stimulation of radiation. Some of this radiation may be visible as the characteristic bright line spectrum of the element.

Each line in the spectrum represents a particular “quantum jump” that an electron can make for that atom. Each line also represents radiation of a definite wavelength of frequency. The energy is a quantum of radiation of that frequency also can be calculated. This quantum is the energy lost by an electron as it changes levels in the atom.

Purpose:

In this experiment, you will identify the bright line spectra as the fingerprints of the certain elements. You will explore atoms in a sample that are excited as the same as they give off various frequencies of radiation. When their electron drop back to their ground state, (energy levels), they emit light.



Using the Spectroscope:

When using a spectroscope, eliminate as much external light as possible so that the only light entering the instrument is due to the light source being examined. If the source is a gas emission tube, **DO NOT TOUCH IT!** Gas emission tubes operate at high voltages and will cause electric shocks if touched.

After your teacher has set the gas emission tube and power supply up,

* Take the spectroscope and hold it up to your eye. (Don’t directly touch the spectroscope to your eye.)
* Hold the smaller part up to your eye and look into the light. Line the left slit up with the light and read the spectral lines. The image above show you what this should look like!.

Draw Spectral Line diagrams for: different light bulbs (in the gas emission tubes!)

Hydrogen

4000 5000 6000 7000

|  |
| --- |
|  |

Mercury

4000 5000 6000 7000

|  |
| --- |
|  |

Neon

4000 5000 6000 7000

|  |
| --- |
|  |

Additional samples and the Unknown

Discussion questions:

1. Explain why things fluoresce.

2. What is meant by the statement, “Spectral lines are fingerprints of elements.”

3. What do you call the band of light that is produced when white light is passed through a prism?

4. What do you call the band of light that is produced when fluoresced light is passed through a prism?

4000 5000 6000 7000

|  |
| --- |
|  |

4000 5000 6000 7000

|  |
| --- |
|  |

4000 5000 6000 7000

|  |
| --- |
|  |

4000 5000 6000 7000

|  |
| --- |
|  |

Practice Quiz: Atomic Structure, P,N,E, Isotopes, Electron Configuration, etc.

1. Explain in **detail** Rutherford’s experiment and its significance to the model of the atom. Include a labeled diagram!!!

2. Species Atomic Mass Atomic No. Protons Neutrons Electrons Charge

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| tritium |  |  |  |  |  |  |
| 88 +2  Sr  38 |  |  |  |  |  |  |
|  |  | 22 |  | 26 |  | 0 |

.

3. An unknown element has the following information:

a. Isotope Mass Isotope Abundance

17.989 82%

19.101 18%

Calculate its average atomic mass

b. Calculate the abundance of each of the isotopes given the following information:

Average atomic mass= 79.215 amu Isotope 78 = 78.112amu Isotope 79 = 79. 521 amu

4. Electron Arrangement

Long Method Energy Level Energy Level Electron Configuration Orbital Notation Electron Dot

Notation Diagram

a. Sulfur

5. Short Method / Noble Gas Core(kernel)

a. Tungsten X X

6. Draw the electron configuration(long method) for element # 116

Practice Test: Atomic Structure, P,N,E, Isotopes, Electron Configuration, etc.

1.

Species Atomic Mass Atomic No. Protons Neutrons Electrons Charge

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| deuterium |  |  |  |  |  |  |
|  |  | 11 |  | 12 |  | + 1 |
|  |  |  | 15 | 15 | 18 |  |
| 40 + 2  Ca  20 |  |  |  |  |  |  |

2. Mass 30 29 28 27 26 25 24 23

Sample A

Abundance 11.17 10.13 78.79

a. What are the atomic masses of the isotopes in spectrum A ? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Based on the experimentally obtained values of atomic mass and percent, calculate the average mass of this element. Show your work.

c. What are the name and symbol of this element? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. What are the symbols including superscripts and subscripts of the isotopes of this element? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Explain in **detail** Rutherford’s experiment and its significance to the model of the atom. Include a labeled diagram!!!

4. Naturally occurring boron consists of 10B(10.013 amu) and 11B (11.009 amu). The atomic mass of boron is 10.811 amu. What is the relative abundance of each of the two isotopes?

5. Electron Arrangement

Long Method Energy Level Energy Level Electron Configuration Orbital Notation Electron Dot

Notation Diagram

1. Calcium

2. Gold

Short Method

Noble Gas Core(kernel)

5. Strontium X X

6. Uranium X X